

## DIGITAL CORDLESS TELEPHONE

The present invention relates to a digital cordless telephone, specifically to a digital cordless telephone provided with a transceiver mode that allows a direct communication between cordless hand sets of the PHS (Personal Handy System).

The PHS is stipulated to communicate in conformity to the RCR STD-28 being the standard (ARIB Standard) of the second-generation cordless telephone system determined by the Association of Radio Industries and Business of Japan. The clause 2.10 of the standard states, regarding the 'direct communication between cordless hand sets', the effect of the provision of the function that "a mobile station of this system shall be capable of a direct and mutual communication between mobile stations without intervention of a base station (direct communication between cordless hand sets) as an auxiliary communication means in an area where the communications with intervention of the base station are impossible, and so forth".

The direct communication between cordless hand sets in the above standard will approve a use as a transceiver between PHS cordless hand sets registered in advance with the parent equipment within the permissible scope of the Wireless Telegraphy Act (the exceptive clause of the fourth article, the

Wireless Telegraphy Act). However, it is very rare that a PHS owner practices the use as the transceiver. As the reason, there are conceivably inconveniences, such that the cordless hand sets have to be registered in advance with the parent equipment, or with fellow cordless hand sets. And in addition, the power consumption in the waiting state by the transceiver is comparably high; there is also a demand that the equipment is desirably put in the waiting state only when it is used in the transceiver mode.

As a conventional example to solve the above problem is disclosed the JP-A No.339768/2001, which involves a disadvantage that, since the system deals with unspecified speakers, it will reveal an inter-cordless hand set group calling code and extension number to the other party whom the group members do not want to communicate with. Also, the example still has the problem of the power consumption in the waiting state. The JP-A no.285934/2001 premises that the cordless hand sets are registered with the parent equipment in advance; therefore, the above problem regarding the registration of the cordless hand sets is not basically solved. In this regard, the JP-A No.11-88960, JP-A No.11-88952, and JP-A No.10-155177 are the same.

The JP-A No.10-200955 discloses the invention in the Claim 1 thereof, "a mobile telephone with an automatic

communication switching function that receives the service from a communication enterprise, which is specialized by providing a function that transmits a control signal from a transmitting-side telephone, and sets the same frequency as that of the transmitting-side telephone to a receiving-side telephone, and an automatic communication switching function capable of detecting the response of the receiving-side telephone to a test radio wave from the transmitting-side telephone, and capable of switching the communication into the transceiver communication in a communication between mobile telephones". Although this invention includes an inconvenience such as 'registering the cordless hand sets with the parent equipment' and so forth, this is the same as the present invention described hereunder, in view of the system that switches into the transceiver communication by using a public telephone line. However, the system is to properly use 'two different tone signals' and switch into the transceiver communication. Since the system uses the tone signals during a communication, the system involves an inconvenience such that the communication has to be disconnected temporarily and a second communication has to be established. The other data communications in the PHS also involve similar inconveniences.

In this manner, when a transceiver communication is performed between cordless hand sets of the PHS, it involves

the inconvenience that the cordless hand sets must be registered in advance, and the requirement to achieve the reduction of the power consumption in the waiting state. Also, in the system that switches into the transceiver communication by using a public telephone line is demanded an easy and simplified system in conformity to the sequence of the PHS. Further, the system bears a social demand not to leak secret information on the communication to unspecified speakers.

#### 10 Summary of the Invention

In order to solve the above problem, the present invention adopts a system that sets the group identification code for direct communication between personal stations and extension number in the public communication system conforming to the ARIB standard, in a normal communication between specified speakers. The system employs a called party subaddress information element and so forth in the call setting messages, for transferring information such as the group identification code for direct communication between personal stations, and so forth. The present invention adopts the system that conforms to the sequence of the PHS, and switches the waiting mode according to the contents of only the 'control signal' (CC control signal in this invention). Therefore, the system does not involve the inconveniences that the conventional inventions

hold, such that the communication has to be disconnected temporarily and a second communication has to be established, in order to carry out the normal (original) communication.

5      Brief Description of the Drawings

Fig. 1 is a sequence chart until starting a direct communication between cordless hand sets in the embodiment according to the present invention;

Fig. 2 is a flow chart until a receiving party determining  
10      to change the waiting mode, in the embodiment according to the present invention; and

Fig. 3 is a chart illustrating the configuration of the called party subaddress information element, based on the embodiment of the invention.

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Detailed Description of the Preferred Embodiments

The embodiment of the present invention will now be described in detail. The embodiment of the invention adopts the system that sets the group identification code for direct  
20      communication between personal stations and extension number in the public communication system conforming to the above standard, in a normal communication between specified speakers. That is, the system of this embodiment transmits necessary information to the other party by means of a public telephone

network, and lets the other party prepare for receiving.

Fig. 1 illustrates a sequence until starting a direct communication between cordless hand sets, in this embodiment. In Fig. 1, the left side shows a transmitter PS1 (Personal Station 1), which is linked with a cell station CS1, and the right side shows a receiver PS2 (Personal Station 2), which is linked with a cell station CS2. When the transmitter PS1 calls the receiver PS2 through a public telephone network 101, in order to make a conversation with the receiver PS2 in the transceiver mode, the sequence first executes a CC (Call Control) call setting S103, which is unique to the invention, to the cell station CS1 linked with the transmitter PS1. The CC setup S103 signifies the called party subaddress information, etc., unique to the invention described later, which includes information for requesting to change the waiting mode, and so forth.

The calling by the transmitter PS1 calls the receiver PS2, as a calling S104 from the cell station CS2 to the receiver PS2. As the receiver PS2 responds to this paging S104, the information is answered to the cell station CS2 as a RT paging response S105. Here, the RT is an abbreviation for the Radio Frequency Transmission Management, which signifies the processes of the setting, maintaining, switching, disconnecting and recovering of the network connection in the

wireless interval interface of the second-generation cordless telephone system, and the location registration and authentication of the personal stations. Receiving the response from the receiver PS2, the cell station CS2 transmits  
5 to the receiver PS2 a CC setup S106 corresponding to the CC setup S103 of the transmitter PS1.

Receiving the CC setup S106, the receiver PS2 normally stores in the internal memory of the own PHS the information that the transmitter PS1 transmitted, such as the waiting mode  
10 change and so forth. The information includes the transmitter telephone number, identifier for requesting to change the waiting mode, designated waiting mode, group identification code for direct communication between personal stations, and PS station number, and so forth. The information of the other  
15 party is displayed on the display unit as needed.

Further, the conventional example designates the extension number used in the transceiver mode by utilizing the password contained in the transfer message. However, this embodiment directly designates the extension number as the PS  
20 station number (hereunder, referred to as the extension number).

Whether to or not to accept the transmitter's request to change the waiting mode and so forth is determined in principle by the receiver on the basis of the display (S107 in Fig. 1).

Fig. 2 illustrates a flow until the receiver determining to change the waiting mode. In Fig. 2, when the CC setup (S106) in Fig. 1 is received (S201), this embodiment is made capable of determining whether to automatically change the waiting mode (S202). If the step automatically changes the waiting mode (Y at S202), next whether to compare with the telephone directory can be selected (S203). Here, the telephone directory signifies a certain data stored in the internal memory, etc., of the PHS, and a telephone book is one example thereof.

10       The objects of comparison are the information to thereby identify the relevant transmitter, such as the names and telephone numbers of acquaintances on the list of the telephone directory, and other electronic mail addresses, etc. If the relevant party is not present on the telephone directory (N at 15 S204), since the waiting mode change is automatically selected already, the CC disconnection is made without CC call proceeding (S205). In terms of the transceiver, this means disconnecting the line automatically in response to the calling from the other party. To execute this disconnection before ringing a 20 receiving melody and the like will make it possible to prevent harassments, etc.

If the comparison with the telephone directory is not executed (N at S203), and if the relevant party is present on the telephone directory (Y at S204), the waiting mode is



automatically changed (S206). Thereafter, to inform the transmitter of accepting the CC setup, the step transmits a CC call proceeding (S207).

In this embodiment, only when the waiting mode is not  
5 automatically changed (N at S202), the information of the transmitter's number and the like are to be displayed on the display unit of the PHS (S209), however the display may be made independently. If the setting of automatic mode change is selected, and if the relevant transmitter is present on the  
10 telephone directory, the information is also given on the display unit (S210).

If the waiting mode is not automatically changed (N at S202), thereafter the judgment by the receiver is executed (S212). This judgment will be made with reference to the above  
15 information displayed on the display unit. As the result, if the waiting mode is changed (Y at S213), the waiting mode is changed in practice (S206), and then the CC call proceeding is transmitted (S207). And, if the waiting mode is not changed (N at S213), the CC disconnection is made without CC call  
20 proceeding (S205).

Returning to Fig. 1, the sequence of the direct communication between the cordless hand sets will be disclosed, when the change of the waiting mode and so forth are executed (S107). In Fig. 1, the receiver transmits the CC call

proceeding (S108) for notifying the transmitter that the changes of the waiting mode and so forth have been executed. Thereafter, the receiving side terminates the communication with the cell station CS2, in order to execute the change into the waiting mode that the transmitter desired. This termination is executed by the notification of the CC release (S110) from the cell station CS2, which responds to the CC disconnect (S109) from the receiver PS2, and the notification of the CC release complete (S111) from the receiver PS2, which responds to the former notification.

The CC call proceeding (S108) from the receiver PS2 is transmitted to the transmitter PS1 through the cell station CS1. Receiving this information, the transmitter PS1 normally changes the own mode into the same waiting mode as the transmitter requested the receiver; thereafter, the transmitter PS1 terminates the communication with the cell station CS1. This termination is executed by the notification of the CC release (S114) from the cell station CS1, which responds to the CC disconnect (S113) from the transmitter PS1, and the notification of the CC release complete (S115) from the transmitter PS1, which responds to the former notification.

According to the standard norm, the inter-cordless hand set group calling code is notified to the other party as the transfer message. However, the embodiment of the invention

adopts the system that employs the called party subaddress information element and so forth, described later, in the CC setup (S103), as to the information required for the transition to the transceiver mode, such as the inter-cordless hand set group calling code, and so forth. Therefore, this embodiment  
5 does not use the transfer message for transferring the inter-cordless hand set group calling code and so forth.

Thus, according to the above sequence, the cordless hand sets of both the transmitter PS1 and the receiver PS2 were  
10 transferred to the transceiver mode on a public telephone network. And thereafter, the direct communication between the cordless hand sets (102) is made by means of the message for the direct communication between the cordless hand sets. The call-out in the transceiver mode may be made from either side  
15 of the transmitter PS1 and the receiver PS2, however this embodiment discloses the system to make the call-out from the transmitter PS1. When the transmitter PS1 calls the receiver PS2, the inter-cordless hand set group calling code and the extension number of the receiver PS2 are designated, and the  
20 call message is directly transmitted without intervention of the cell stations as the message for the direct communication between the chilled equipments, on the basis of the CC call proceeding (S112), thus the direct communication between the cordless hand sets is carried out (S116). The receiver PS2

compares the group identification code for direct communication between personal stations and the extension number that are contained in the call message with the data contained in the internal memory of its own. If the result conforms, the  
5 receiver PS2 transmits a synchronization message as the message for the direct communication between the personal stations (S117). In the same manner, the transmitter PS1 transmits the synchronous message as the message for the direct communication between the chilled equipments (S118), whereby both the  
10 transmissions are established.

On reaching this stage, as the receiver PS2 who received the call hooks off the PHS to make the conversation (S119), the receiver PS2 transmits a connect message (S120) as the message for the direct communication between the personal stations, in  
15 order to notify the transmitter PS1 of starting transmission. Receiving the connect message, the transmitter PS1 transmits a TCH (Transfer Channel) idle burst to the receiver PS2, and waits for the receiver PS2 reaching the TCH starting state (steady state) (S121). Also, the receiver PS2 transmits the  
20 TCH idle burst to the transmitter PS1, and waits for the transmitter PS1 reaching the TCH starting state (steady state) (S122). At this stage, both become the TCH starting state in the end, which allows the communication by the transceiver mode (S123).

The conventional example transmits the transfer message for transferring the group identification code for direct communication between personal stations before the alerting message, and automatically executes the setting of the receiving-side cordless hand set, by such a contrivance that utilizes the password (the password itself is to conceal the group identification code for direct communication between personal stations) contained in the transfer message as the extension number. In contrast to this, the embodiment of the present invention adopts the system that automatically executes the change of the waiting mode of the receiving-side cordless hand set and so forth during a normal communication through a public telephone network, and the information of the system is not the transfer message that is normally used, but the called party subaddress information element, etc., contained in the CC call setup (S103 in Fig. 1) in the public communication.

Fig. 3 illustrates the configuration of the called party subaddress information element according to the embodiment. The called party subaddress is used for identifying the subaddress on the receiving side. Here, the subaddress signifies the numbers added on after the telephone number to make a call directly get to an extension of a private telephone switchboard (PBX) and so forth. The called party subaddress information element in its self is optional, and has a high

degree of freedom in format, but it is restricted to 23 octets maximum. In Fig. 3, the first octet is composed of an extended bit of the 8<sup>th</sup> bit, and information element identifier (7 bits) not more than the 8<sup>th</sup> bit. In this case, the information element identifier is the called party subaddress (1110001). The second octet is an information element content length, and is the called party subaddress content length in this case. The third octet is composed of an extended bit of the 8<sup>th</sup> bit, a subaddress type from the 7<sup>th</sup> through the 5<sup>th</sup> bit, a display as to whether the number of the 4<sup>th</sup> bit address signal is even or odd, and a reserved area from the 3<sup>rd</sup> through the 1<sup>st</sup> bit. Here, as the subaddress type is adopted a user unique subaddress (101). This comes from that the subaddress information more than on the fourth octet is composed with a unique configuration in the embodiment of this invention.

The fourth octet is a waiting mode change request identifier that is a unique configuration in the embodiment of this invention. This information element identifier indicates that this message shows the content of the transmitter PS1 demanding the waiting mode change to the receiver PS2. The fifth octet is an area for designating the waiting mode, and the content is shown in the following table.

Bit	mode
00000000	only for registration (mode change unavailable)
00000001	public
00000010	private
5 00000011	transceiver (direct communication between cordless hand sets)
00000100	public + private
00000101	public + transceiver
00000110	private + transceiver
10 00000111	public + private + transceiver

Here, 'public' signifies a communication using a public cell station, 'private' signifies a communication using a parent equipment of a home digital cordless system, or a cell station of a company or business cordless system, and 'transceiver' signifies a communication by the direct communication between cordless hand sets by the PHS. The waiting mode designation '00000000' is for registering the group identification code for direct communication between personal stations and so forth, but not executing the waiting mode change. This is effective in the case of completing only the setting before using the transceiver mode in practice.

The sixth through ninth octets are allocated for the group identification code for direct communication between personal

stations composed of 29 bits. The group identification code for direct communication between personal stations should originally be transmitted to the other party as a transfer message with the password attached, as the standard norm or the conventional examples. However, the embodiment of this invention adopts the configuration that is transmitted to the other party as the subaddress information of the called party subaddress information element. The tenth through eleventh octets are allocated for the PS station number, which is used as the extension number. This embodiment employs the public telephone network (101), and is able to fix this PS station number comparably freely, which is advantageous.

The embodiment of this invention has disclosed the system using the called party subaddress information element. However, the information element identifiers contain a calling party subaddress having a format similar to the called party subaddress. Accordingly, using the calling party subaddress will make up the same configuration as the called party subaddress according to the embodiment of this invention.

According to the embodiment of the invention as described above, the system is adopted which utilizes a public telephone network to send necessary information to the other party, and lets the other party prepare for receiving. Therefore, if the mode is set to be changeable in advance, it will allow using



the transceiver easily with the PHS of a specified person. Since the system uses a public telephone network, the interventions of unspecified persons can be prevented to secure the secrets of communications. In addition, the waiting itself  
5 by the transceiver becomes unnecessary, which reduces the power consumption during waiting. Besides, the system saves a troublesome registration work regarded as necessary with the transceiver of the PHS.

The conventional 'system that switches into the  
10 transceiver communication by using a public telephone line' is the system that properly uses the 'two different tone signals' to switch into the transceiver communication. The system of the present invention conforms to the sequence of the PHS, and switches into the transceiver communication according to only  
15 the contents of the 'control signal' (CC control signal in this invention). Thus, the communication systems of both are different. Therefore, the conventional system is not able to secure the secrets of communications in the transceiver communication, and not able to reduce the power consumption  
20 during waiting. However, the present invention is able to satisfy these requirements sufficiently. And, the conventional system properly uses the 'two different tone signals' to switch into the transceiver communication, after establishing a communication, and the system uses the tone

signals during the communication. Thus, the conventional system involves an inconvenience such that the communication has to be disconnected temporarily and a second communication has to be established. However, since there does not occur such  
5 inconveniences in the present invention, it is possible to shorten the time until entering a conversation on the transceiver communication.

In a remote area where a public telephone network is not available, the system according to the embodiment of this  
10 invention can be restricted. There are conceivably quite a few demands for this system in the areas where public telephone networks are available. It is also possible to change the setting in advance in the areas where public telephone networks are available. In that case, the present invention allows using  
15 the transceiver with ease in a remote place from the cell station, which will not conceivably impair the effectiveness of the invention.